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A new anamorphic rust fungus with a new record of *Uredinales* from Azad Kashmir, Pakistan

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Abstract — *Milesia kashmiriana* on *Athyrium dentigerum* is described as a new species, with *Puccinia coronata* var. *himalensis* as a new record for Pakistan.

Key words — *Hyalopsora,* Muchal, Neelum Valley, Sharda

Introduction

Azad Kashmir is a floristically rich area from which only about 23 species of rust fungi have been reported (Ahmad et al. 1997). In order to explore this floristically rich area, extensive surveys were carried out. During such surveys of the rust flora of Azad Kashmir, Pakistan, one member of Pteridophytes, *Athyrium dentigerum*, was found infected with a new anamorphic rust fungus *Milesia kashmiriana* belonging to *Pucciniastraceae*. Another rust, *Puccinia coronata* var. *himalensis*, is the first member of the *Uredinales* ever reported on *Piptatherum vicarium*.

Materials and methods

Freehand sections of infected tissue and spores were mounted in lactophenol and gently heated to boiling. The preparations were observed under a NIKON YS 100 microscope and photographed with a JSM5910 scanning electron microscope. Drawings of spores and paraphyses were made using a Camera Lucida (Ernst Leitz Wetzlar, Germany). Spore dimensions were taken using an ocular micrometer. At least 25 spores were measured for each spore stage. The rusted specimens have been deposited in the herbarium of the Botany Department, at the University of the Punjab, Lahore (LAH).

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Enumeration of taxa

Milesia kashmiriana Afshan, S.H. Iqbal, Khalid & Niazi, **sp. nov.** (Figs. A–D)

MycoBank MB 516713

Telia ignota. Uredinia amphigena, subepidermalia, flavido vel aurantio- flavidae. Urediniosporae, ovoideae, ellipsoideae vel pyriformae, dilute flavido vel aurantio- flavidae, 11–17 × 21–37 µm;, poris germinationis 1–4, aequatorialibus; membrana 0.9–2 µm crassa, pariete levi vel echinulato; pedicellis hyalinis, 2–3 × 8–24 µm.

Holotype: On *Athyrium dentigerum* (Clarke) Mehra & Bir, Pakistan, Azad Jammu & Kashmir, Neelum valley, Muchal, at 3000 m a.s.l., 03 November, 2006. NSA # 786. (LAH Herbarium No. NSA 1020).

Etymology: Named after the locality, Azad Jammu & Kashmir.

Telia not observed. Uredinia amphigenous, golden to yellow or yellowish orange, erumpent, powdery, covered by the epidermis or soon naked, scattered or irregularly grouped, rounded, 0.06–0.09 × 0.3–0.4 mm. Urediniospores ovoid to ellipsoid or nearly cylindrical to pyriform, light yellow to yellowish orange, sometimes with yellowish orange granules, 11–17 × 21–37 µm; germ pores 1–4, equatorial, capitate; wall 0.9–2 µm thick, smooth or finely echinulate; pedicel hyaline, minute, thin, 2–3 × 8–24 µm. Paraphyses absent.

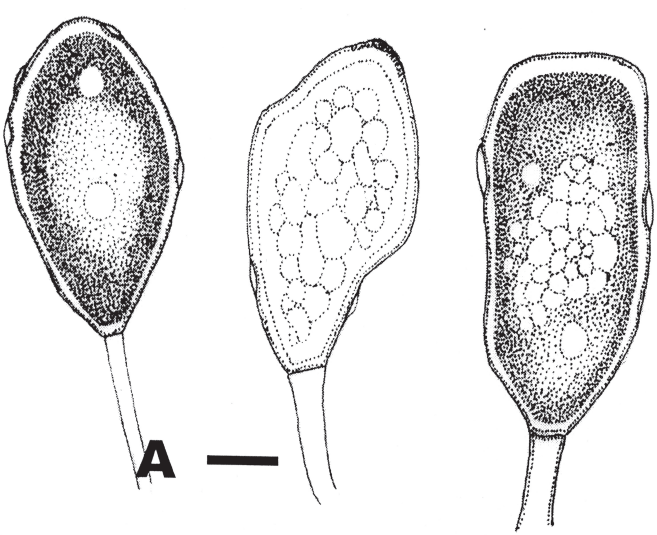
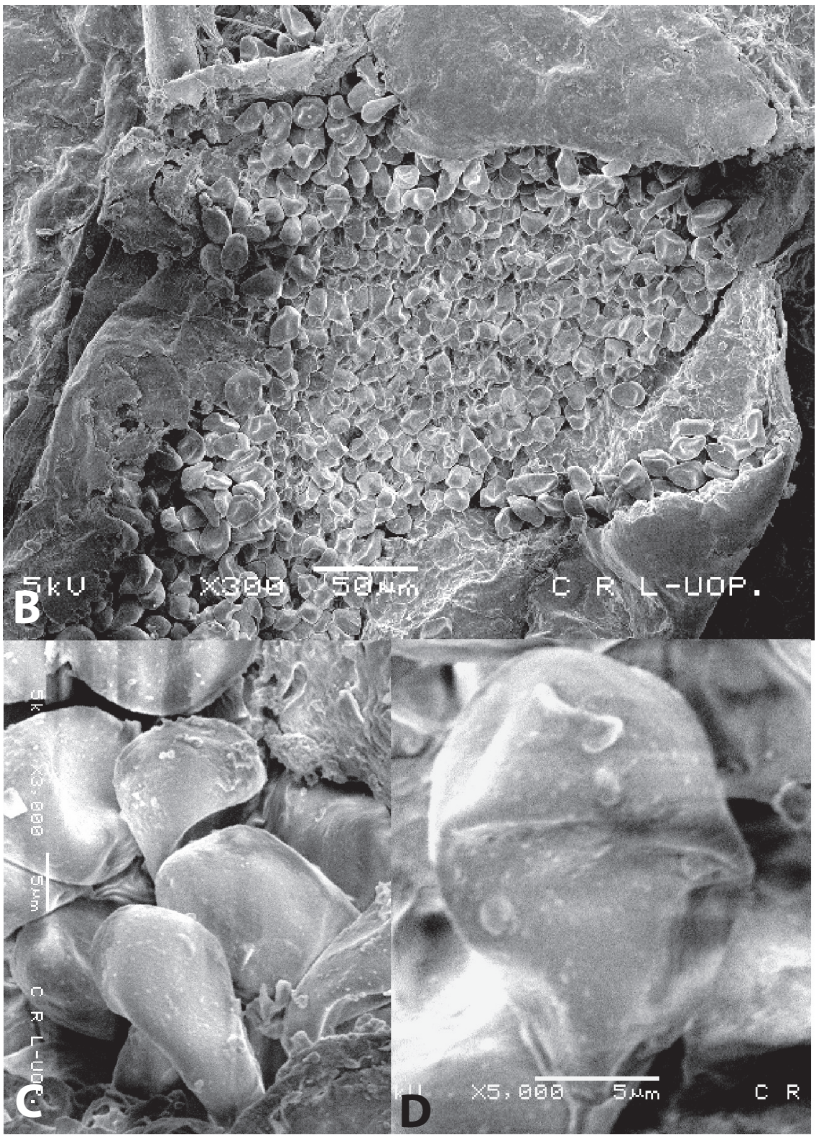


Fig. A: Lucida drawing of urediniospores of *Milesia kashmiriana* sp. nov. (type). Scale bar = 12 µm.

Comments: The uredinia of genera *Hyalopsora, Milesina* and *Uredinopsis* (*Pucciniastraceae*) are classified in the anamorph genus *Milesia*. *Milesia*



Figs. B–D: *Milesia kashmiriana* sp. nov. (type)
(B). Cross section of uredinium containing urediniospores
(C). SEM photograph of urediniospores (D). A finely echinulated urediniospore.

kashmiriana most probably belongs to the genus *Hyalopsora* because of the morphological characters of urediniospores and uredinia.

Urediniospores of *Milesia kashmiriana* and *Hyalopsora polypodii* (Pers.) Magnus 1901 resemble each other in urediniospore shape and wall ornamentation, but *H. polypodii* has shorter urediniospores (17–27 µm) with 3–5 scattered germ pores.

Urediniospores of *M. kashmiriana* are different from those of *H. hakodatensis* Hirats. f. 1932 in size and shape; *H. hakodatensis* has shorter urediniospores (20–27.5 µm).

Uredinopsis intermedia Kamei 1932 differs in its larger (12–30 × 18–32 µm), wedge-shaped or rhomboidal urediniospores.

Urediniospores of *M. kashmiriana* also differ from the larger (15–23 × 23–42 µm) spores of *H. diplazii* Hirats. f. 1940. Moreover, the absence of paraphyses and the presence of smooth to finely echinulate urediniospores distinguish *M. kashmiriana* from *H. diplazii,* which has a few paraphyses and distinctly verrucose urediniospores.

Milesia kashmiriana is similar to *Uredinopsis daisenensis* Hirats. f. 1936 in a few respects, but the presence of shorter urediniospores (21–37 µm vs. 21–43 µm) with smooth to finely echinulate wall ornamentation and the absence of beaks differentiates it from *U. daisenensis.*

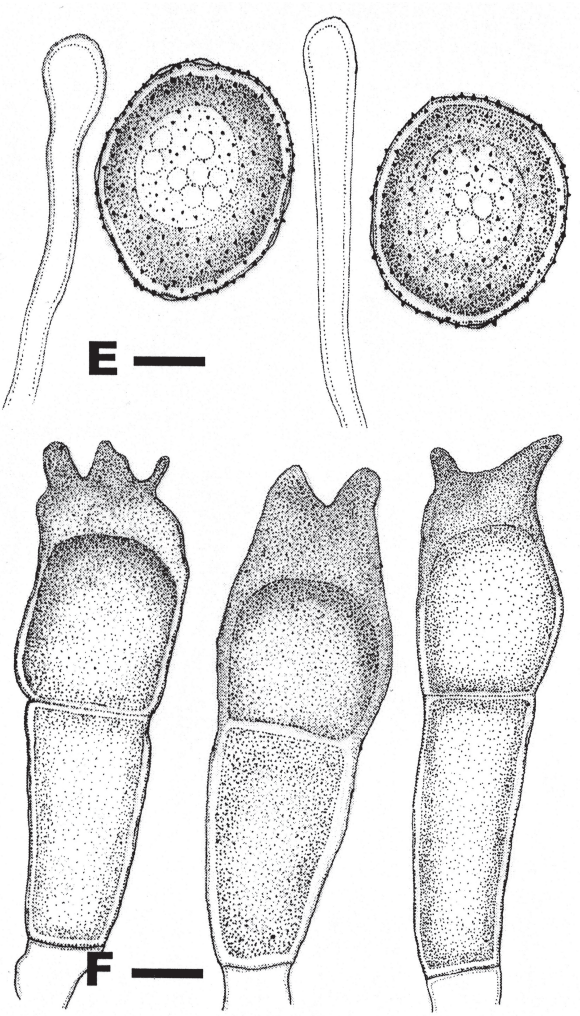
Uredinopsis komagatakensis Hirats. f. 1943 has shorter (17–32 µm) urediniospores with smooth or few longitudinal lines of minute papillae on the spore walls that contrast with the smooth to finely echinulate urediniospores in *M. kashmiriana* has.

On the basis of the above-mentioned comparisons, the present species seems new to science but will be kept in the anamorph genus *Milesia* until the telial stage is discovered.

Puccinia coronata* var. *himalensis Barclay, Trans. Linn. Soc. London, Bot., Ser. 2, 3: 227 (1891) (Figs. E–F)

Spermogonia and aecia unknown. Uredinia amphigenous, brown, 0.07–0.09 × 0.1–0.3 mm. Urediniospores globose-subglobose or ovoid, 13–19 × 14–21 µm; germ pores (2–) 4–8, scattered, obscure; wall 1.5–2 µm thick, pale yellow to nearly colorless, echinulate; pedicel minute, deciduous. Paraphyses clavate, apex 12–13 µm wide while 7–9 µm thick below, up to 50 µm long. Telia amphigenous, long covered by the epidermis, or only tardily exposed, without paraphyses, blackish brown, sori 0.06–0.08 × 0.09–0.2 mm. Teliospores golden to brown, paler basally, 14–19 × 27–47 (–54) µm, wall up to 2 µm thick at sides while about 2–5 µm thick apically excluding digitations, apex coronate with digitations, 4–12 µm long; pedicel short, yellowish brown to brown, 8–9 × 9–15 µm.

Material examined: On *Piptatherum vicarium* (Grigorj.) Roshev. (= *Oryzopsis microcarpa* Pilg.), with II, III stages, Pakistan, Azad Jammu & Kashmir, Neelum valley, Muchal, at 3000 m a.s.l., 03 November, 2006. NSA # 907. (LAH Herbarium No. NSA 1047).



Figs. E–F: Lucida drawings of *Puccinia coronata* var. *himalensis* (E). Echinulated urediniospores (F) Coronate teliospores. Scale bar = 10 µm.

Comments: *Puccinia coronata* var. *avenae* W.P. Fraser & Ledingham 1933, *P. coronata* Corda 1837 var. *coronata,* and *P. coronata* var. *gibberosa* (Lagerh.) Jørst. 1949 have previously been reported from Pakistan (Afshan et al. 2008, Ahmad et al. 1997, Iqbal et al. 2008).

Puccinia coronata var. *himalensis* has been reported on different members of *Poaceae* from Europe to India, Japan and North and South America (Cummins

1971). The variety is a new record for Pakistan, and *Piptatherum vicarium* represents a new host for the *Uredinales*.

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